

Minutes of Committee Meeting - Project 1-721-2  
10:00 A.M., Monday, 21 October 1957

Dr. Lemcoe, Project Leader, presided. Attending personnel were:

Mr. R. B. Ladd	Industrial Economics
Dr. M. M. Lemcoe	Engineering Mechanics
Mr. W. A. Mussen	Electrical Engineering
Dr. S. F. Orochena	Chemistry
Mr. A. G. Pickett	Engineering Mechanics
Dr. G. Pish	Physics
Dr. W. E. Thompson	Chemistry
Dr. E. Wenk, Jr.	Engineering Mechanics

all of Southwest Research Institute.

The meeting was opened with a statement of the objectives to be accomplished at this meeting: firstly, it was considered essential to construct a framework of proposed action to present to the Planning Committee for its approval; secondly, it was considered necessary to obtain a list of the information which would be desirable to have before the next project staff meeting.

Memos representing suggested approaches to the problem by the various departments were then read and discussed in detail.

It was the consensus that the applicability of an Operations Research or statistical approach to the problem could best be determined after a visit to the sponsor and after knowledge is gained as to how much data is actually available. It was also believed that any solution reached would be a compromise between total cost and optimum retention of fidelity and that, in any event, the statistical approach should be neither sophisticated nor extensive until much more is known about the problem.

It was requested that specifications or other information from

OK  
infringement

the sponsor regarding his player equipment be obtained as soon as possible.

Regarding the chemical aspects of the problem, it was brought in-  
to the discussion that various classes of materials of which records are  
made, should be studied individually so as to identify and evaluate those  
elements which have an adverse effect on fidelity or record life. It was  
also felt that a comparison should be made between chemical deterioration  
(aging) and use <sup>wear</sup> deterioration (wear) and that a correlation be made between  
existing record environment and record deterioration.

500,000 It was felt by some that there may be a possibility of storage of  
groups of records in plastic cylinders in a controlled atmosphere, with  
simple mechanical selection incorporated in the playback equipment to  
minimize the handling and dust menace. This technique might be limited  
to those records where chemical deterioration, rather than mechanical  
wear is the controlling factor. In any event, before this aspect is  
looked into, it would be necessary to determine what the Planning Com-  
mittee would permit in the way of basic departures from the present system.

It was established during the course of the discussion that, at  
best, collection of dust on the records could be minimized, but not elim-  
inated. To this end, silicone coatings of the records, irradiation, and  
dust precipitators might be worthy of further consideration.

The matter of the relative merits of horizontal vs. vertical stack-  
ing was discussed. It was pointed out that the record manufacturers had  
been polled on this by the sponsor but they apparently could only offer  
general advice.

The matter of the great danger in variability of record materials,  
fillers, and processes was discussed with respect to the probability of  
finding a common basis for the preservation of records. It was felt that,

in spite of this variability, there were many parameters common to all plastic materials, which varied only in degree from material to material and for this reason would be amenable to the same type of solution.

The problem of embrittlement and the protection against embrittlement was discussed. It was stated that certain coatings might be used which would not affect fidelity, and at the same time minimize oxidation, etc. However, this would not provide protection against auto-deterioration from interaction of the chemical constituents within the material, and the possibility of loss of fidelity due to the presence of diffusion forces in the plasticizers would have to be looked into.

*No  
LC  
letter*

A suggestion was made that a questionnaire be circulated throughout the record industry to obtain information on record materials used. The question of propriety of information was discussed in this connection. Nevertheless, it was felt that some manufacturers might not be reluctant to supply information on formulae or materials they are no longer using, but that they used in the manufacture of records which might be included in the Library of Congress collection. It was also pointed out that one manufacturer had already furnished the compositions of one or more of the materials used by them for manufacturing records.

The relative merits of different means of establishing control for accelerated testing were discussed. Limits of acceptability to be used in accelerated testing and the best way to help the sponsor decide what limits to set for quality were discussed. Two basic categories were suggested: (1) complete unintelligibility (speech records) and (2) fidelity loss of a prescribed amount (music records). The question was raised as to possibility of development of means of reproduction which would minimize physical damage by mechanical action. It was felt that it was

*Wrong approach as starter? What can we expect?*



not possible, at least at this time, and that project interest must be concentrated on storage. A question arose as to the establishment of playback control procedures, as part of this program, to maintain playback equipment adjustment with respect to stylus wear and pressure, etc. to reduce record damage. It was felt that this would be investigated and that for the present it would be considered that this was a controllable parameter and that storage could be concentrated on. It was strongly felt by some that, for future deterioration standards, these two problems of aging and mechanical wear were inseparable and that use, wear, and storage deterioration must be correlated.

Regarding project staff co-ordination, the need for co-ordinating the theoretical approach with Dr. Prager at the earliest opportunity was discussed. It was recommended that the Chemistry Department be responsible for the conduct of certain specific chemical tests, that the Electrical Engineering Department be responsible for the conduct for certain acoustic tests, and that availability of existing data for possible statistical or OR analysis by the Department of Industrial Economics be determined at the earliest possible date. For laboratory testing, ASTM procedures would be used, where applicable, in the absence of better standards.

An outline was given of the mechanical parameters, including residual stress, creep, and long time elastic recovery, which would be investigated by Engineering Mechanics and it was pointed out that a study of these parameters would basically be a study of change in groove geometry as a response to residual and applied stresses. Again, the question of playback damage was emphasized and the necessity for obtaining complete data on present storage and playback facilities, as well as use and deterioration experience data.

*Need for rotation blank & grooved discs*



A tentative program outline was proposed (see Attachment No. IV) for consideration which emphasized the need for avoiding exceedingly costly procedures at the outset, the limitations of time and funds, and the necessity for a probing attack to find strategic approaches to the situation. It was suggested that the questionnaire to manufacturers and visitations with the sponsor should be included in Phase I. It was also suggested that statistical planning of experiments should also be included in Phase I.

The meeting was concluded with a summarization of the points covered and conclusions reached, and it was proposed that no further general meetings would be held until after a visit to the sponsor was made.

Attachment No. V is a list of the more pertinent questions raised during this meeting and in other discussions, for consideration by the sponsor prior to a meeting in Washington in the immediate future.

October 14, 1957

MEMORANDUM

To: Mike Lemcoe

From: Boyd Ladd

Subject: LIBRARY OF CONGRESS PROJECT 1-721-2

I. THE PROBLEM

*What is happening to materials?*

The objective is an engineering design which will provide the desirable level of storage protection for Library of Congress phonograph records.

The design includes: the facility which controls environment, unit protection of records by treatment or individual jackets, and the operational procedures employed in storing, circulating and playing the records.

The desirable level of storage protection represents a compromise between total cost and maximum retention of playing fidelity.

II. PROJECT WORK PROGRAM

From the writer's standpoint, the needed steps to do an effective job for Library of Congress seem to be:

- A. Formulating a clear-cut concept of where we are going and what we have to do to get there.

This is the purpose of the meetings, this collection of ideas, and in part of the forthcoming Project Committee meeting in Washington.

- B. Collection of Basic Data

1. Much of the basic information must come directly from Library of Congress - especially

- a. operating statistics and costs
- b. inventory statistics
- c. value information (the relative importance of different degrees of life and fidelity)

2. Identifying significant causes of degradation

- a. Assembling opinions and engineering judgments (including literature search)
- b. Experimental measurements on specimen "degraded" records

C. Experimental Program

- 1. Using test records and simulated deterioration on an accelerated time scale, the effects of each "cause" and any interaction between "causes" should be estimated.
- 2. Possible means for suppressing damage (suggested by others, and devised by SwRI) should be tested for effectiveness under the same experimental situations.\*

The "possibility" of any suggested means should be judged in practical terms of costs, screening out in advance of experimental work those whose cost is certain to lead to their elimination in the analysis stage. Considerable latitude for imaginative approaches should be retained, however, with an eye open to potentials for dual use, for example.

- a. Environmental Controls
- b. Unit Protection
- c. Operating Specifications

D. Analysis

1. Costs

The operating and the capital costs for each element considered for the storage system should be estimated on the current and projected volume of record collection.

2. Summary evaluation

The analytic approach will depend heavily on the general conception of the program. A Monte Carlo appraisal of the large number of degradation effects, protective means effects, and values, may be appropriate.

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\* The time scale for an accelerated test is generally imputed by indirect evidence. Any error in inference as to time scale affects the findings. The comparison between an "unprotected" and "protected" situation is preferred under the same experimental situation.



Thus, based on a costs-effectiveness model of the phonograph storage problem, the elements of protective method which are reasonable candidates for inclusion in the overall system might be tried out empirically, using numerical estimates developed in the experimental program, to find an optimum combination. Depending on the amount of detail and number of possibilities, this might be a desk calculator analysis or it might be adapted to the E-102.

Such a model, some aspects of which are suggested throughout this memorandum, would be a formal expression of the relationships of the many factors entering the problem. If a model approach is to be used, it should be consciously constructed early in the program, to guide the data collection so that the parameters are collected in fully consistent form throughout the experimental program.

In many instances, problems which can be formulated from a general standpoint as an OR problem, are found in practice to reduce to strictly engineering development jobs, because most alternative approaches or systems are ruled out by costs differentials of an order of magnitude, say. This may be such a case. It may be helpful, however, to conceive of the problem in OR terms, without committing ourselves to elaborate and expensive mathematical model-building, until the experimental development begins to reveal the possibilities available in system-design.

#### E. Design of Storage System

1. Facility for Controlling Environment
2. Treatment of Individual Units of Recorded Matter
3. Procedures for Circulation and Re-Transcription
  - a. Mechanical and routine procedures for handling of records
  - b. Policies as to limitations on circulation
  - c. Practices as to re-recording

### III. SOME OF THE DECISIONS INVOLVED

#### A. Criteria for Degradation

1. What?

*Secondary* (2% distortion of fundamental, for music records, perhaps?) Separate criteria are probably appropriate for transcribed conferences (where distortion less than very severe would not obscure meaning), for "popular music", and for high fidelity music masterpieces. For the latter, a multiple-criterion may be needed. For

example, should such things be considered as: loss of relative amplitude of harmonics, and fidelity in the frequency - ratios of consecutive notes, as well as fidelity in the absolute frequency of the fundamental?

2. How determined?

2  
This seems clearly to be the responsibility of the sponsor to define for each category of records just what degree of impairment in quality is critical for use. SWRI technical advice is relevant, but I think we should make sure that LC has opportunity to make the decision, explicitly.

B. Definition and Classification of the Population

1. Categories

The total group of phonograph records on hand and being accessioned should be analyzed separately in classes defined by SWRI in terms of:

- a. Applicable criteria for degradation, and
- b. Types of materials which experience significantly different loss in quality with time and use and other wear (physical and chemical properties).

2. Evaluative Studies

Experimentation, literature review, and engineering judgments may be conducted on the basis of test records by types of material only (regardless of classes 1a), provided the range of conditions extends far enough to cover the differential requirements for different use-categories of records.

C. Use-Value

never mind  
playings  
shelf-life  
Very high fidelity for very long time is theoretically possible, at high cost. The factor of cost requires some compromise with the ultimate in preservation. Further, it is possible that for a given cost, a choice might be posed between retaining a given recording for 100 playings over 100 years, or for 400 playings over ten years.

Some decision is required as to the value of a playing at a given time in the future, or at least as to the relative value of playing at different future times. A considered judgment on this surface reflecting value as a function of time and use is critical to the solutions developed.

A quick off hand consideration suggests that the simplest criterion-equal value at any time - is not consistent with holding recordings in a library at all.

#### IV. BASIC FACT-FINDING FROM LIBRARY OF CONGRESS

Regardless of the formulation of this project, certain basic information from Library of Congress will be highly desirable if not essential. Some of this is probably already available but it should be assembled in systematic form, I believe. The statement of data requirements should include:

##### A. Inventory Data

? 1. Number of records now on hand, by age and neat type of record.

*all important* 2. The distribution of records as between high fidelity music, ephemeral music, and language records in which distortion short of major confusion is not a problem.

? 3. What sub-classes are there in the whole record library in which the records are separately maintained, so far as public access and administration of circulation are concerned.

? 4. What is the rate of accession of recordings, by type?

##### B. Operations Data

? 1. Circulation rates at this time by various classes of records.

*Wrong project* 2. Staff time, and other costs in current operation - for accessioning records, circulation of records, shelving, listener assistance. (out-of-pocket costs).

3. Present form of cataloging and of record arrangement, in other words, the access possibilities.

4. Circulation mechanics.

- a. Are records loaned only for on-premise listening?
- b. Number of machines now used for within-library playing of Library Congress Records.
- c. Customary time lag in securing a record when requested at Library of Congress.
- d. Is there queueing in use of record players?
- e. Are there special rules about handling of records?



C. Specifications for Criteria and Values

Either explicitly or implicitly, weights or relative values must be assigned to different degrees of permanence of fidelity in the records.

1. Criteria for Degradation -(IIIA) "How bad would each class of record have to be to be discarded?" is one approach.

2. Use-Value (III-C)

D. Information on Kinds and Extent of Damage

V. DEPT. 7 PARTICIPATION

As it now appears, Department 7 can contribute to this project primarily in:

- A. Assisting to the extent desired with the collection of basic data (II-B), and with the design of experiments for evaluating the effects of various degradation factors and of environmental or other controls and preventives (II-C).
- B. The development of an operations research model of this problem, in the event that it is desired to view it in that light, and in its solution when parameters have been developed (see II-D).
- C. Finally, in the design of operating procedures to go with the storage facilities design (II-E) as part of a "storage system", especially if this is viewed from the standpoint of attaining an optimum in effectiveness related to costs.

Boyd Ladd

BL/id

ATTACHMENT NO. II

COMMENTS ON THE LIBRARY OF CONGRESS  
RECORD STORAGE PROBLEM

*was*  
*physical*  
? This problem has to do with the preservation of records belonging to the Library of Congress. The objective is to determine the best method of storing these records so as to maintain their fidelity over the longest period of time possible. The problem breaks down into basically two parts. One has to do with deterioration of the records due to chemical breakdown. The other has to do with mechanical change in the records due to methods of storage, handling, use, etc.

✓ With regard to the chemical change the records are of various ages and various kinds of material so about the only thing possible is to consider the factors which would affect materials of this type in general. These factors are as follows: light, temperature, humidity, contamination, dust, and possibly fungus attack. *This is the 1st part of project - main part*

*no*  
✓ In general, light, particularly ultraviolet rays, are known to have deleterious affects on plastics materials; however, it is probably true that in a library of this type the amount of light present is very small and this factor probably need not be considered. High temperatures are of course, in general, deleterious but the place is probably air conditioned and, if it is not, it should be. Humidity control is also important. High humidity could cause sweating with relatively minor temperature changes. Sweating of the records could possibly leach out some of the plasticizers and would also encourage the growth of fungus. Extremely low humidities might be equally as bad by causing bleeding of the plasticizers. Most materials of this type absorb a certain amount of water and there is probably some equilibrium water content at which they are the most stable. Tests should be run to determine what humidity yields the best stability. Extremely low humidities might also tend to increase the rate of loss of plasticizers. It is probable that the air conditioning system will control the humidity level adequately. *sell your Congressmen!*

*no*  
Dust in the storage area should be held at a minimum and, again, the air conditioning system probably has filters which take care of this angle. The composition of the surrounding atmosphere should be considered also. It is probable that increased life could be obtained if the records were stored in an oxygen-free atmosphere. This may not be a practical thing to do. On the other hand, if it turns out that the most practical method of storage from a mechanical standpoint involves the records in some sort of containers it might be feasible to maintain an atmosphere with a reduced oxygen content. Atmospheric contaminants should be considered. It is possible that certain air contaminants leaking in from the outside could be having deleterious effects. If so, these materials could be removed with some sort of a chemical absorbant placed in the make-up air duct work. Sweat from the hands of people handling the records is another possible contaminant.

These general comments may be more or less significant depending upon the composition of the records, upon the final mechanical storage method devised, and upon the amount of gain that might be accomplished by a change in the chemical atmosphere.

? There is also the possibility of applying some protective coating which would have beneficial effects by making the records less susceptible to damage from humidity or by retarding the loss of plasticizer from the material or by reducing the rate of oxidization at the surface. Such coatings must not affect fidelity or result in blister formation. It is also possible that if the records are stored in individual paper wrappers a chemical treatment of the wrappers themselves might be effective in reducing the rate of oxidization. ✓ If fungus growth is a problem, a fungus inhibitor could be incorporated in the treatment of the paper or in the coating applied to the records.

✓ Although practically all of the suggestions mentioned above are, in general, worthwhile considering in a problem of this sort, the first phase of the study should be an attempt to determine the factors which seem to cause most of the damage. Possibly one or two of the above suggestions will account for 90% of any improvement that can be made.



16 October 1957

M E M O R A N D U M

TO: E. Wenk  
FROM: Wm. A. Mussen  
SUBJECT: Instrumentation for Record Storage Program

Attached is a memorandum from M. J. Prucha summarizing the instrumentation requirements and techniques recommended for use in connection with the record storage program. It is considered that the instrumentation phase of this program should be the responsibility of Department 6; simulation of storage conditions, detection of physical and chemical effects, etc., can best be performed by other appropriate departments. The instrumentation outlined in the memorandum will provide a quantitative evaluation of actual recording quality, and it will probably be desirable to attempt to correlate these data with the causative effects which account for recording degradation.

It is specifically recommended that each storage test include one or more of each of the three types of test records which are enumerated. In addition, for comparison purposes, a control set of test records should be available for use in conjunction with each test. The test records will be subjected to instrumentation at regular intervals during each storage test, and progressive degradation, if any exists, will be measured.

This procedure should be followed with each type of record which is subjected to storage testing. The test records for any type of record should be made up in accordance with the best modern techniques which are compatible with the particular type of record and the material of which it is composed.

*Old records in duplicate if possible*

WAM:c  
Enclosure  
CC - M. John Prucha

14 October 1957

M E M O R A N D U M

TO: W. A. Mussen  
FROM: M. J. Prucha  
SUBJECT: Instrumentation Requirements for 721-2, Library of Congress Program

A. Purpose of This Memorandum:

*visual physical as well as acoustical*

The purpose of this memorandum is to describe the instrumentation that is considered necessary to determine the extent of degradation of disc and tape recordings by measuring the degree of distortion and loss of transcription quality that is introduced by ageing and handling effects. This will involve the measurement with suitable electronic equipment of distortion, frequency response, and noise in the electrical signal obtained when the records are played back on suitable playback equipment.

B. Measurements Required:

Degradation of a recording may be observed by measuring the playback signal for an increase in any or all of the following:

1. Harmonic Distortion.
2. Intermodulation Distortion.
3. Overall Attenuation (Loss of Amplitude).
4. Frequency Response Limits (Attenuation as a function of frequency).
5. Background Noise.
6. Echo Effect.

*If you can play it at all*

Harmonic and intermodulation distortion in the electrical signal in a record playback system will have three components; distortion of the original signal as recorded on the record, distortion resulting from degradation of the record, and distortion generated in the playback head (or transducer) and its associated amplifiers during playback. The original signal distortion may be determined by measuring new recordings or old ones that have not degraded, or by using standard test records made for the purpose. The distortion of the signal by the playback transducer and amplifiers can be determined by measurement; it can be kept small by the use of precision components for the playback equipment.

Both overall attenuation and attenuation as a function of frequency (loss of frequency response) will require the use of standard pre-recorded test records for comparison measurements. The accuracy of measurement will be limited by the reliable, repeatable accuracy of the playback equipment.

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TO: W. A. Mussen

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Background noise measurements, for controlled tests, will require the use of pre-cut, but unmodulated or blank records. The measurement of noise from the record will require the use of low-noise type playback amplifiers, and the noise sensitivity of the playback head must be determined. The measurement of pulse type noise arising from cracks, voids, pits or other irregularities in the record medium will involve measuring the number of pulses, their amplitudes, wave forms and durations. The measurement of continuous hiss-type of noise will involve measuring the amplitude, and the spectral energy distribution. Echo effect, which might be considered a form of noise, will be from adjacent groove pickup on discs, and from print-through on magnetic tapes. The measurement of crosstalk will be the determination of its average amplitude relative to the standard or average signal level, and will be expressed generally in decibels.

There are a number of ageing effects which will affect the reproduction from records. These include:

1. Material Creep.
2. Embrittlement.
3. Fungus Growth.
4. Warping.
5. Checking and Crazeing.
6. ~~Playing Wear.~~
7. Dust and Dirt Collection.

Of these, the first four are forms of degradation which should be visible or produce visible effects before serious loss of transcription quality results. Therefore, it is not considered likely that they would be measured by the techniques described in this memo.

C. Measurement Techniques Proposed:

Harmonic and I.M. distortion may be measured by two basic techniques:

1. Comparison of the distorted signal against the undistorted signal, with a direct or indirect measurement of the differential.
2. Direct measurement of the distortion components frequencies and amplitudes by means of a harmonic wave analyzer, or narrow band filter and voltmeter.

Overall attenuation and frequency response measurements will require the preparation of standard signal test records upon which have been recorded standard amplitudes and frequencies. Direct measurement of playback signal voltage is required. The addition of band-pass filters may be required, if the signal levels are down near the noise.



MEMORANDUM  
TO: W. A. Mussen

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Background noise measurements will require the use of pre-cut but unmodulated test records. Pulse-type noise measurements will require the use of pulse amplifiers and counters. Evaluation may be made, however, by photography of oscilloscope displays of the pulse waveforms. The measurement of continuous-type noise will require the use of integrating-type meters, and the use of band pass filters for spectral energy distribution measurement.

Cross-talk measurement may be estimated from analysis of existing recordings, provided the original cross-talk level at the time of recording is known. Accurate measurement would require the use of standard pre-recorded test records.

*warping measurements, flaking, etc.*

D. Equipment Required:

The following is a list of the minimum equipment considered necessary for making the above measurements.

1. Playback Equipment (for Discs):

- We have better*
- a. Precision Turntable: using a hysteresis-synchronous type drive motor with a 16" diameter turntable, and providing all desired speeds. Suggested unit: Rek-O-Kut #B-16H at \$250.00. (Note: For 12" diameter, Rek-O-Kut #B-12H at \$129.95.)
  - b. Pickup Arm: a precision 16" arm with universal cartridge mounting. Suggested units: Gray 108C at \$39.95, or Orthosonic V/4 at \$44.50.
  - c. Pickup: A complete set of pickups that will permit playing all types of records involved in this study. Vertical transcription pickup heads are not standard and would have to be specially obtained. Suggested units: for 78 rpm, Fairchild #225B at \$37.50, for Microgrooves, Fairchild #225A at \$37.50.
  - d. Preamplifier-Equalizer: A low distortion, low-noise unit with all necessary equalization characteristics for the records to be tested. It should also have an NARTB equalized magnetic tape input for use in the magnetic tape study part of this program. Suggested unit: Fisher #80-C at \$99.50.

2. Instruments:

- a. Low-Distortion Audio Oscillator: Two required.
- b. R.M.S. type of A.C. Voltmeter: Two required.

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TO: W. A. Mussen

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- c. Harmonic Wave Analyzer: One required.
- d. Variable Frequency and Band Width Band-Pass Filter: One required.
- e. Total Distortion Meter: One desired.
- f. Oscilloscope and Camera: One required.

The distortion meter described above is the only instrument not available.

3. Special Materials:

Test Records:

- a. Blank Discs, with precut unmodulated grooves, in sufficient quantity to permit all evaluation tests.
- b. Standard Frequency Test Discs, with bands recorded at fixed frequencies from outside in, of 1 kc., 2 kc., 4 kc., 7 kc., 10 kc., 12 kc., 15 kc., 18 kc., 1 kc., 18 kc., 15 kc., 12 kc., 10 kc., 7 kc., 4 kc., 2 kc., and 1 kc. These should be recorded on one side at constant velocity, and on the other at RIAA equalization, or equivalent, depending on the record type. Recorded at standard reference level.
- c. Sweep Frequency Test Records, varying from 1 kc., to 10 kc., to permit evaluation of cross talk.
- d. Actual Sample Records for evaluation.

acetate  
+  
pressing  
tape

Test Record Types:

- a. Early acoustic type recordings: Requiring special equipment. (Before 1920?)
- b. Early Electric Recordings: Mostly usable with 78 rpm equipment. (1920 - 1930)?
- c. Acetate Disc Recordings: (1930 - 1945)? Both 78 and 33-1/3 rpm used.
- d. Plastic Discs., Long Play Types: (1945 - Present) 78, 45, and 33-1/3 rpm used.

4. Playback Equipment for Magnetic Tape Records:

- a. A high quality tape transport mechanism is required for satisfactory measurements on tapes. The Ampex equipment now available

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*enough* is not considered adequate, since it is not adaptable as a half-track recorder, and has only 7-1/2 and 15 i.p.s. speeds available. Furthermore, its condition is unknown; needing some factory adjustment.

b. The preamplifier-equalizer described for use with discs would be equally useful for tape record playback.



ATTACHMENT NO. IV

MEMORANDUM


TO: M. M. Lemcoe  
FROM: E. Wenk, Jr.  
SUBJECT: Project on Audio Transcriptions  
Library of Congress  
680-2

In view of the limited funds and time available for the project, the large number of factors which may adversely affect record life, I should like to suggest the following procedures:

Phase I - Duration, 3 months  
Estimated cost, approximately \$10,000

- a) From a list of all deleterious effects which can be stated without detailed study, review and evaluate all items, and eliminate those believed to be of little significance.
- b) For those remaining, design and conduct a number of very crude exploratory tests in which the conditions are so exaggerated as to accelerate degradation.

Such tests would explore creep at elevated temperatures, effects of oxidation, etc. so as to determine from purely exploratory sallies whether one effect is more pronounced than others.

-  c) Determine loss in fidelity and volume due to wear so that items in part b) could be evaluated in terms of both loss in fidelity and effects of repeated playing.
- d) Anticipate possible solutions such as thin metallic films and study feasibility.

Phase II - Duration, 6 months  
Estimated cost, \$25,000

- a) Conduct experiments under control conditions to investigate those items which were found from Phase I to warrant detailed study.
- b) Introduce results from earlier feasibility studies; that is, study only those items which from considerations of feasibility tests would appear practicable as solutions to degradation.

(ATTACHMENT NO. IV, CONT.)

Phase III - Duration, 3 months  
Estimated cost, \$10,000

- a) Recapitulate results from Phase II and determine whether program is in need of re-orientation.
- b) Determine which additional tests, if any, are necessary
- c) Develop in more detail mechanical and chemical means of counteracting causes of degradation from earlier studies.

Phase IV - Duration, 2 months  
Estimated cost, \$5,000

Complete final reports on project

ATTACHMENT NO. V

Questions or Information Needed  
Pertaining to Existing Sponsor's Record Library

1. Inventory data of records now on hand, as to number, size, age, type (music, speech, etc.), number of times checked out, source of manufacture, if known, replaceability, etc.
2. Are original recordings ever loaned out? *no*
3. Approximately what percentage of the records are played with the sponsor's equipment? *all*
4. Approximately what percentage of the records are unusable due to their age, and what percentage are unusable, or have been disposed of, due to damage or wear. *e*
5. What criteria is now used to determine when a record is no longer considered usable from the standpoint of fidelity (music) or intelligibility (speech)? *Look at it or play - broken grooves*
6. What data is available as to anticipated frequency of use of specific records or specific categories of records, say, once a week....or once every several years, on the basis of past use? *varies*
7. What kind of player equipment does the sponsor have and how often is the sponsor's player equipment checked as to stylus wear and stylus pressure?
8. What procedure is used to periodically clean the records? *none*
9. How are the various records stored?
  - a. On edge?
  - b. Flat wise?
  - c. In individual jackets? If so, what kind?*} both in albums, barrels, boxes etc.*
10. How many people are involved in the current operation, insofar as accession, distribution, circulation, shelving, listener assistance, equipment maintenance, etc., is concerned? *?*
11. To what extent would air conditioning be permissible, if it is already not in use, so as to provide regulation of temperature, humidity, and dust? *yes*
12. Is a floor plan drawing of the present record library available for reference purposes. *yes*